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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	09/855,382
Applicants	:	Takuya Yamamoto et al.
Filed	:	May 15, 2001
Title	:	METHOD FOR MANUFACTURING PRINTED WIRING BOARD
TC/A.U.	:	1765
Examiner	:	S. Ahmed
Docket No.	:	47163-00037

APPEAL BRIEF PURSUANT TO 37 C.F.R. §§ 1.191 AND 1.192

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, postage prepaid, in an envelope addressed to: Mail Stop Appeal Brief-Patents, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on March 19, 2004.

Signature: Deborah Ricks
Deborah Ricks

Mail Stop Appeal Brief—Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Dear Sir:

This is the Appellant's brief in the subject application. A Notice of Appeal was mailed January 22, 2004 and received at the United States Patent and Trademark Office January 26, 2004, so that this brief is being filed within the two month period provided in 37 CFR 1.192(a).

REAL PARTY IN INTEREST

The inventors named in this application have assigned the application to Mitsui Mining & Smelting Co., Ltd., the real party in interest.

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RELATED APPEALS AND INTERFERENCES

There are no known related appeals and interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

STATUS OF CLAIMS

Claims 1, 2, 4, and 5 are on appeal. Claim 3 has been cancelled.

STATUS OF AMENDMENTS

Claims 1, 2, 4 and 5 were rejected in the Final Office Action mailed July 23, 2003. Amendments to Claims 1 and 4 were submitted in the response mailed October 22, 2003. The Examiner's Advisory Action, mailed November 12, 2003 refused entry of the proposed amendments. After a request for reconsideration was mailed November 24, 2003, a second Advisory Action was mailed December 23, 2003 in which the Examiner maintained his rejection, but indicated that the proposed amendments would be entered for purposes of appeal.

SUMMARY OF INVENTION

The Applicant's invention relates to the use of copper foils having a rough exposed surface to make possible the drilling of vias with a carbon dioxide layer. As they explained at pages 3 and 4, drilling of holes with lasers is difficult because the surface of the copper reflects the laser light.

> *"... since the surface of a copper foil has a certain brilliance, and thus has the property of reflecting laser light, the second type laser abrasion[1] is difficult." (page 3, lines 16-19).*

Consequently, a common procedure etched away an area in the surface of copper foils to expose the underlying resin before laser drilling.

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[1] second type laser abrasion refers to applying the laser light directly to the copper surface (see page 3, lines 13-16)

> *"... in the case where the above mentioned second type laser abrasion is carried out to form the desired holes, it is necessary to first perform an etching treatment to remove an external copper layer from an area in which the holes are to be formed...this is the conformal mask method which has already been well-known." (page 3, line 27 to page 4, line 5).*

The Applicants noted that while YAG lasers could be used to drill holes in copper foil, carbon dioxide lasers presented problems.

> *"... although using YAG laser will not cause any problem in treating a copper foil layer, using a carbon dioxide {laser} will make it difficult to treat the copper foil, rendering it impossible to ensure a stable hole formation process." (page 4, lines 22-26).*

The Applicants discovered that the surface of copper foils exposed to carbon dioxide lasers should have a "wave-like shape", shown in Fig. 3 to correspond to a roughness of 2.0 – 20.0μm R_z.

> *"The feature of this invention exists in the copper clad laminate. Such a copper clad laminate has external copper foil layers formed by using copper foils each having a wave-like shape or corrugated configuration." (see page 6, lines 10-13).*
>
> *"... the shape of the waves are required to be maintained properly in order to achieve a roughness range, R_z, or 2.0 to 2.0.0 μm." (page 7, lines 21-23).*
>
> *"If the surface roughness is less than the lower limit of 2.0 μm, it will be impossible to improve the workability when using laser light to form holes in a copper foil layer. On the other hand, if the surface roughness is larger than 20 μm, deterioration will began to occur in the workability when*

laser light is used to form holes in the copper foil layer." (page 10, line 3-9).

The Applicant's explained the effect of using a surface having their preferred roughness.

"... the temperature rise in the mountain-like portions will be 6 times as fast as the temperature rise in the flat portions. As a result, with the start of the laser light irradiation, the temperature will be increased suddenly and rapidly in the front portions of waved areas... the temperature in the waved areas can easily arrive at the boiling point of copper, thus causing the copper to be evaporated." (page 10, line 18 to page 11, line 3.)

Briefly stated, the invention is a method for successfully drilling via holes in copper foils with carbon dioxide lasers by selecting copper foils having a surface roughness of 2.0 – 20 μm, R_z.

ISSUES

1. Does the combination of Shin et al. (JP-10075069A) with Taneda et al. (U.S. 5,263,243) and Yates et al. (U.S. 6,372,113) make Claims 1 and 4 obvious and thus unpatentable?

2. Does the combination of Shin et al. with Taneda et al and Yates et al, and further with Ando et al. (U.S. 5,382,333) make Claim 2 obvious and thus unpatentable?

3. Does the combination of Shin et al. with Taneda et al., and Yates et al., and further with Kataoka et al. (EP-0996318) make Claim 5 obvious and thus unpatentable?

GROUPING OF THE CLAIMS

All of the claims stand and fall together. Claim is the only independent claim; Claims 2, 4, and 5 depend from Claim 1.

REMARKS

Issue 1

Claims 1 and 4 have been rejected under 35 USC 103(a) as unpatentable (i.e. obvious) over Shin et al (Shin) in view of Taneda et al (Taneda), further in view of Yates et al (Yates). Shin was cited for a process of making a multi-layer printed wiring board, but failed to teach the use of a carbon dioxide laser. Taneda was cited for teaching that both YAG and carbon dioxide lasers can be used to make via holes. Yates was cited for forming a waved copper foil having a surface roughness of about 3-8 microns for improving bonding to a resin substrate. While Yates did not teach the roughness of the present invention, the Examiner contended that optimization was obvious to one skilled in the art. These references are not sufficient individually and in combination to make the present invention obvious.

Shin was cited for a process of making a multilayer printed wiring board including, forming a via hole with a laser, plating the resulting laminate to form an interlayer connection, applying an etch resist, and forming a circuit pattern. Shin teaches the use of a YAG laser, not a carbon dioxide laser, as is evident from the title of the patent. As the Applicant's stated in the paragraph beginning at line 20 on page 4, and quoted above, YAG lasers can be used to make via holes, but carbon dioxide lasers present problems to makers of multilayer printed wiring boards. Although the interchangeability of YAG and carbon dioxide lasers was suggested by Taneda at column 7, lines 22-24, Tanaka teaches the superiority of excimer lasers. More importantly, Tanaka did not use lasers to make via holes through copper foils. Instead, Taneda teaches the art that the copper foil layer is removed first to expose the resin underneath before drilling via holes (see Claim 1 and column 6, lines 24-26). That is, Taneda does not recognize the problem addressed by the Applicants, but actually uses the conformal mask method mentioned in the present application at pages 3 and 4 and cited above. Therefore, Tanaka does not supply the information missing in Shin, but actually teaches a prior art method. The alleged equivalence of YAG and carbon dioxide lasers is irrelevant to the present invention. The Applicants have found them not to provide equivalent results.

Yates discloses a method of smoothing the roughness of the matte side of copper foil by depositing particles in the valleys. The present invention includes no such method. Yates

objective was to make a more uniform roughness on copper foils used in multi-layer boards and preferred an R_z value of 3-8. There is no suggestion that the exposed side should have a roughness such that it could be drilled with a carbon dioxide laser. In fact, Yates makes no reference to using lasers to drill via holes. Therefore, there is no reason one skilled in the art would combine Yates with Shin and Taneda.

Issue 2

Claim 2 has been rejected under 35 USC 103(a) as unpatentable over Shin in view of Taneda and Yates and further in view of Ando et al (Ando), who is cited for the use of rust prevention layers. Claim 2 depends from Claim 1. If Claim 1 is patentable, as argued above, then Claim 2 should also be patentable, since Ando does not overcome the deficiencies of the principal references and has no relation to the use of carbon dioxide lasers to drill via holes. Ando actually teaches a process in which copper oxide is formed on the surface of a copper foil and then reduced to form a "fine roughness". Applying rust preventing coatings was done to prevent reoxidation of the copper particles.

Issue 3

Claim 5 has been rejected under 35 USC 103(a) as unpatentable over Shin in view of Taneda and Yates, further in view of Kataoka et al. (Kataoka), who is cited for the use of a carrier foil and improved laser drilling. As with Claim 2, Claim 5 is dependent from Claim 1 and should be allowable if the Board agrees that Claim 1 is patentable. Kataoka teaches the application of a layer of particles that facilitates laser drilling (see paragraph 0067). Kataoka states that his particle layer has an advantage over copper foils when lasers are used to drill via holes. In the present invention, the layer exposed to laser drilling is an electrodeposited foil, not a layer of particles, and the difficulty of drilling with carbon dioxide lasers is overcome by using copper foils have a roughness in the range of 2-20 μm, R_z.

CONCLUSION

The Applicants contend that the Examiner's rejections under 35 USC 103(a) are not supported by the cited references. The references do not suggest the Applicant's invention and are at best only background information that would leave one skilled in the art with no direction toward a solution of the Applicant's problem, namely how to successfully drill via holes in

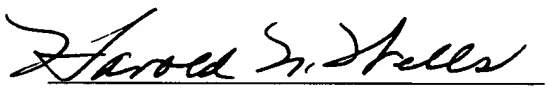
copper foils with carbon dioxide lasers. Accordingly, the Board is urged to reverse the Examiner's rejections.

In accordance with 37 C.F.R. § 1.192(a), the Applicants are submitting this brief in triplicate.

The fee of $330.00 required for this brief is enclosed. The Commissioner is authorized to charge any additional fees inadvertently omitted that may be required (except the issue fee) now or during the pendency of this application to JENKENS & GILCHRIST, P.C. Deposit Account No. 10-0447(47163-00037).

Respectfully submitted,

Date: March 19, 2004



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APPENDIX

Listing of Claims On Appeal

1. A method for manufacturing a printed wiring board, comprising the steps of: using a carbon dioxide laser to form recess via holes in external copper foils of a copper clad laminate; plating said copper clad laminate to form interlayer electrical connections; forming etching resist layers; exposing and developing the etching resist layers; and thereafter effecting a circuit etching treatment, wherein the copper clad laminate is a laminate formed by using waved copper foils having a surface roughness (R_z) of 2.0 to 20μm exposed to said carbon dioxide laser as external copper foils.

2. A method for manufacturing a printed wiring board according to claim 1, wherein each waved copper foil for use in forming the external copper foils of the copper clad laminate includes a bulk copper layer forming a conductor circuit of the printed wiring board, an amount of fine copper particles for ensuring an adhesion strength between the bulk copper layer and a resin substrate, and a rust preventive layer, said bulk copper layer having a thickness of 18μm or less.

3. (Cancelled).

4. A method for manufacturing a printed wiring board according to claim 1, wherein each of the waved copper foils has a surface roughness (R_z) of 10 to 20μm.

5. A method of Claim 1 wherein said waved external copper foils have the surface roughness of a carrier foil used in pressing said laminate.